

Unit IV

- 7. (a) Illustrate the procedure to design an IIR filter by determining $H(z)$ using impulse invariant transformation for the analog transfer function : 12

$$H_a(s) = \frac{2}{(s+1)(s+3)}; T = 0.5s$$

- (b) Describe the difference between Chebyshev and Elliptical filters. 8
- 8. (a) Derive an expression to determine the order of the low pass digital Butterworth filter. 10
- (b) Obtain $H(z)$ from $H_a(s)$:

$$H_a(s) = \frac{s^3}{(s+1)(s^2+2s+2)}; T = 1s$$

using bilinear transformation. 10

Time : Three Hours] [Maximum Marks : 100

Note : Attempt Five questions in all, selecting at least one question from each Unit. All questions carry equal marks.

Unit I

- 1. (a) Find the transfer function, impulse response and frequency response of a causal system with input $x(n)$ and output $y(n)$ are given by :

$$x(n) = \delta(n) + \frac{1}{6}\delta(n-1) - \frac{1}{6}\delta(n-2)$$

$$y(n) = \delta(n) - \frac{2}{3}\delta(n-1)$$

Also check the stability of the system. 12

- (b) Using the properties of z-transform, find the z-transform of the sequence :

$$x(n) = 1, \text{ for } 0 \leq n \leq N - 1$$

$$= 0, \text{ otherwise} \quad 8$$

- 2. (a) Illustrate the decimation in time (DIT) FFT algorithm by evaluating the FFT of 8-point sequence :

$$x(n) = \{2, 1, 2, 1, 2, 1, 2, 1\}$$

- (b) Find the IDFT of :

$$X(k) = \{4, 2, 0, 4\}$$

Unit II

- 3. (a) Realize the following IIR filter using ladder structure :

$$H(z) = \frac{5z^3 + 3z^2 + 4z + 2}{z[2z^2 + 3z + 1]}$$

- (b) Realize the system $H(z) = 5 + 3z^{-1}$ with lattice structure.

- 4. What is difference between cascade and parallel realization ? Determine the cascade and parallel realization of the system described by the difference equation :

$$y(n) + 2y(n-1) - y(n-2) = x(n) \quad 20$$

Unit III

- 5. (a) Illustrate the procedure to design an FIR filter using 'Windows'.

- (b) Describe the design of FIR filter using Fourier series method.

- 6. (a) Design a high-pass FIR filter for the following specifications :

Cut off frequency : 500 Hz

Sampling frequency : 2000 Hz

$N = 11$ 15

- (b) What are advantages and disadvantages of FIR filters ? 5